

# ◆ Skill B Finding interest compounded continuously

**Recall** If the principal,  $P$ , is invested at an annual interest rate of  $r$ , compounded continuously, the amount,  $A$ , in the investment after  $t$  years is  $A = Pe^{rt}$ .

## ◆ Example 1

Find the amount in an account if \$1500 is invested at an annual rate of 5.8% and interest is compounded continuously for 7 years.

## ◆ Solution

$$A = Pe^{rt}$$

$$A = 1500e^{(0.058)(7)}$$

$$A = \$2251.20$$

$$5.8\% = 0.058$$

Use a calculator.

## ◆ Example 2

How long will it take to double your money if you deposit \$500 at an annual rate of 7.2% compounded continuously?

## ◆ Solution

$$A = Pe^{rt}$$

$$1000 = 500e^{(0.072)t}$$

$$2 = e^{(0.072)t}$$

$$\ln 2 = \ln e^{(0.072)t}$$

$$\ln 2 = 0.072t$$

$$t = \frac{\ln 2}{0.072}$$

$$t \approx 9.63$$

\$500 doubles to \$1000

Divide each side by 500.

Take the natural logarithm of each side.

inverse functions:  $\ln e^x = x$

It will take about 9 years and 7.5 months to double your money.

**Find the amount,  $A$ , by using the formula  $A = Pe^{rt}$  for continuously compounded interest.**

13. \$1000 at 4% for 10 years

14. \$800 at 7% for 3 years

15. \$2500 at 5.2% for 6 years

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

16. \$10,000 at 12% for 10 years

17. \$8000 at 8.9% for 2 years

18. \$50,000 at 15% for 7 years

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

19. How long will it take to double your money if you deposit \$1200 at an annual rate of 6.9% compounded continuously? \_\_\_\_\_

20. How long will it take to triple your money if you deposit \$2000 at an annual rate of 8.5% compounded continuously? \_\_\_\_\_

21. **INVESTMENTS** Armando invests \$10,000 at an interest rate of 7.75%. If the interest is compounded continuously, and no additional deposits or withdrawals are made, how much is the account worth after 10 years? \_\_\_\_\_

22. \$1000 is deposited in an account with an interest rate of 6.5%. Interest is compounded continuously, and no deposits or withdrawals are made. Find the amount in the account at the end of three years. \_\_\_\_\_

23. The amount of radioactive carbon-14 remaining after  $t$  years is given by the formula  $N(t) = N_0e^{-0.00012t}$ . How much of a 20 milligram sample will remain after 50 years? \_\_\_\_\_

## ***Applications of Logarithms; Exponential Growth and Decay; The Natural Logarithm Function***

Use a calculator or Table 3 on text pages 812–813 to find each logarithm.

1.  $\log 417$  \_\_\_\_\_      2.  $\log 0.0611$  \_\_\_\_\_      3.  $\log 909,000$  \_\_\_\_\_

Use a calculator or Table 3 to find the number whose common logarithm is the value shown. Give the number to three significant digits.

4.  $\log x = 1.8488$  \_\_\_\_\_      5.  $\log x = 4.2405$  \_\_\_\_\_

6.  $\log x = 6.6920 - 10$  \_\_\_\_\_

Solve the equation first in calculation-ready form and then as a decimal with three significant digits.

7.  $7^a = 39$  \_\_\_\_\_      8.  $11^m = 130$  \_\_\_\_\_      9.  $b^{2.7} = 57$  \_\_\_\_\_

10.  $6^{t+1} = 19$  \_\_\_\_\_      11.  $7^{\frac{c}{3}} = 2.2$  \_\_\_\_\_      12.  $x = \log_3 10$  \_\_\_\_\_

Solve. Give the solution first in calculation-ready form and then as a decimal with three significant digits.

13. The half-life of the Sulfur-35 isotope is 87.1 days. How much of a 2 g sample will remain after 100 days? \_\_\_\_\_

14. Population studies of fiddler crabs on a tropical island reported  $1.1 \times 10^4$  in 1980 and  $1.5 \times 10^4$  in 1982. Predict the time that the maximum population,  $2.0 \times 10^4$ , that can be supported by the island's resources will be reached. \_\_\_\_\_

15. If Heather invests \$2000 in a fund that earns 10%, compounded every 6 months, how much will she have after 20 years? \_\_\_\_\_

Simplify.

16.  $\ln e^5$  \_\_\_\_\_      17.  $\ln e^{\frac{1}{2}}$  \_\_\_\_\_      18.  $e^{\ln 3}$  \_\_\_\_\_

Write as a single logarithm.

19.  $\ln 4 + \ln 3 - 6$  \_\_\_\_\_      20.  $\frac{1}{4} \ln 2 + \ln 4$  \_\_\_\_\_